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Investigation of the Conversion of Laser Energy to Relativistic Electrons at Intensities of 10^{20} W/cm^2

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We report on experiments using the 100 TW laser at LLNL (40J, 400fs,10^{20} W/cm^2 focal intensity) and planar multi-layer targets (Mo/Sn) to study the generation and transport of electrons with MeV energies. Such fast electrons are of prime importance to many proposed applications, e.g., the fast ignitor fusion concept. X-ray emission spectroscopy is used to study the electron transport. Characteristic K-α photon emission produced by the fast electrons in the front (Mo) and rear (Sn) layers of the target is measured with a CCD detector (single photon counting mode) to infer the electron energy deposition. The electron energy spectrum is measured by varying the thickness of the Mo layer to attenuate the electrons by different amounts. In addition, penumbral imaging of the K-α emission is used to give information about the angular distribution of the fast electron emission. Comparisons with monte-carlo simulations reveal that the high-energy electrons contain over 10% of the incident laser energy.

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